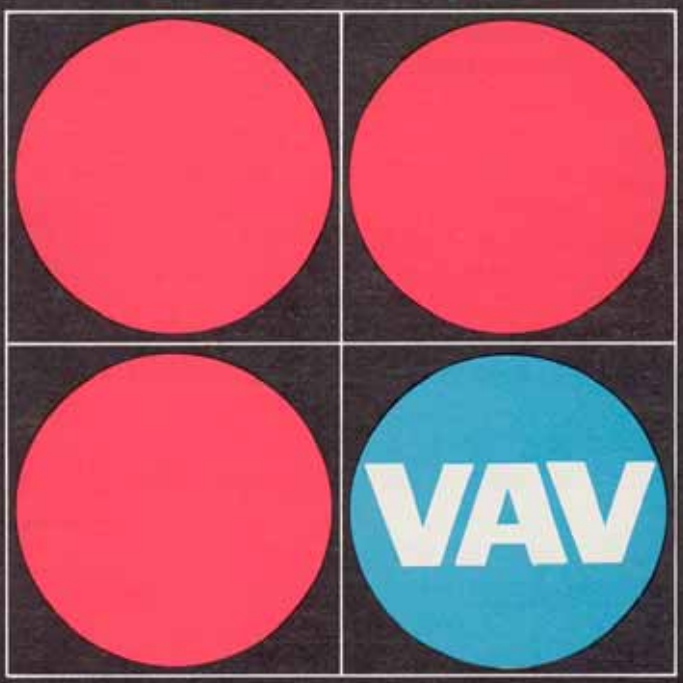
CARNES



TERMINOLOGY

VT-01

FOREWORD

The variable volume method of air distribution has created a new language as unique as the concept itself.

Familiar air distribution terminology has been modified and obsoleted. New modes of operation are responsible for such references as "Reset Constant Volume" and "Full Range Variable Volume".

The Variable Air Volume Terminology section of the Carnes VAV Manual has been compiled to enable the reader to more fully understand the technically-oriented Variable Air Volume Concepts by Carnes.

TERMINOLOGY

A_k

Area factor of air outlet (or inlet), the effective area in square feet as determined by dividing the volume rate of air flow in CFM by the air velocity, V_k, measured at the face of the outlet (or inlet).

AIR CHANGES

A method of expressing the amount of air flowing into or out of a building or room in terms of the number of building volumes or room volumes exchanged. See Air Quantity.

AIR INLET

A device covering the opening (may be the end of the air return duct) through which air is removed from the occupied space.

AIR OUTLET

A device covering the end of the duct through which the supply air is delivered to the occupied space (see—Grille, Register, Diffuser).

AIR QUANTITY

Expressed as:

a. CFM—The amount of air, in cubic feet per minute that is delivered from an outlet into the occupied space (or removed through an inlet). Volume rate of air flow in duct (cubic meters per hour or cubic meters per second).

b. CFM/LF—The amount of air issuing from each foot of the linear diffuser.

c. CFM/SQ. FT.—The quantity (variable on VAV system) of air in cubic feet per minute supplied to each square foot of the conditioned space.

AMBIENT TEMPERATURE

The temperature of the air surrounding an object or a person. Generally, the temperature of the air existing in the conditioned space.

ATTENUATION

The sound reduction process of absorbing and dissipating sound energy between the point of its origin and the human ear. In the process, the sound energy is converted into heat.

BTU	British Thermal Unit—a unit of the quantity of heat. The heat required to rise the temperature of one pound of water one degree Fahrenheit at maximum density. Energy equivalent is 1 BTU = 778 ft. lbs. In metric system, one calorie (cal) is the heat required to rise the temperature of one gram of water one degree Centigrade. One kilocalorie—I kcal = 1000 cal (1 BTU = 252 cal).
BY PASS	Constant fan volume, such as a rooftop unit, with variable room volume. Air not required by the space is diverted into a return plenum or duct.
CFM	Cubic feet per minute; volume rate of air flow. See Air Quantity.
COANDA EFFECT (Tea Cup Effect)	The tendency of an air stream to attach itself to and flow along the closest adjacent surface.
COMFORT	Comfort is best described as the lack of discomfort. Comfort conditions depend on temperature, humidity, air motion, heat radiation, clothing, and mental state and are established, numerically, by statistical methods (when the least number of people are uncomfortable).
CONSTANT VOLUME	Automatic static pressure regulation utilizing the mechanical constant volume control located in the unit.
COOLING LOAD, BTU/hr.	Any heat generated within or infiltrated into the conditioned space and requiring cooling to maintain comfort conditions.
CORE AREA	Interior space of building not affected by the weather conditions outside of the building.
DAMPER	Air flow rate regulating device within the duct system. Often attached to the outlet.
DECIBEL	(db) is a mathematical tool used to express the ratio of two numerical values. It permits using relatively small numbers to handle very large ratios.
DENSITY	Density of standard dry air is .075 lbs./cu. ft. Density of moist air is less.
DIFFUSER	A circular, square or rectangular air outlet comprised of deflecting members generally located in the ceiling and designed to distribute air in varying directions and planes (ADC).
DIFFUSION	Distribution of air within a space by an outlet discharging supply air in a spreading pattern (per ASHRAE—in various directions and plains).
DIRECT ACTING	Thermostat response characterized by a decrease in line pressure (pneumatic) as a result of a drop in temperature.
DIVERSITY	Diversity factor takes into account that maximum loads in different zones do not occur at the same time. It is a ratio of the maximum total of simultaneously occurring load during the day to the sum of maximum loads of all individual zones. Diversity allows use of reduced in size central equipment and duct work.
DOWNDRAFT	Gravity air flow down along the outside wall caused by the loss of heat through the wall to the outside.

DRAFT CONDITION	When the velocity of air in the occupied zone exceeds 75 FPM.
DROP	The vertical distance the lower edge of a horizontally projected air stream drops between the outlet and the end of its throw (See Throw).
DUCT PRESSURE	See Pressure.
DUMPING	The uncontrolled delivery of a cold primary air into an occupied zone as a result of low terminal velocities and insufficient mixing with the secondary air.
DYNAMIC PRESSURE	See Pressure.
EFFECTIVE AREA	The net area of an outlet or inlet device through which air can pass; it is equal to the free area of the device times the co-efficient of discharge.
EFFECTIVE TEMPERATURE	Effective temperature (ET) is an emperical sensory index (expressed in ^{O}F), combining into a single value the thermal effect of temperature, humidity, and movement of air upon the human body. Equal ET under diverse conditions will produce the same sensation of warmth or cold.
ENTHALPY	A thermodynamic property defined as the sum of the internal energy plus a certain calculable quantity. In psychrometry, only enthalpy differences are given with the zero value arbitrarily assigned to the dry air at $0^{O}F$. Thus, enthalpy values as used in psychrometrics consist of the sensible heat of air and water vapor and the latent heat of water vapor and are expressed in BTU. Sometimes enthalpy is referred to as total heat.
ENTRAINMENT	The induced flow of room air (secondary air) by the primary air (supply air) from an outlet, creating a mixed air path.
ENVELOPE	The outer boundary of an air stream moving at a specified velocity (for example, a 50 FPM envelope of a grille).
EXHAUST AIR	The conditioned and used up air which is exhausted to the outside. The heat content of this air in excess or below the enthalpy of the supply air to the building is considered a loss and is partially recoverable by air-to-air heat transfer devices (such as Carnes T-O-W).
EXTERIOR LOAD	Solar transmission, weather conditions, etc., imposing either a heating or cooling effect on a building from the outside. See Load.
EXTERIOR ZONE	Spaces affected by the weather conditions, usually those adjoining outside walls and roof. Called perimeter zone also.
FPM	Feet per minute. See Velocity.
FREE AREA	The total minimum area of the openings in an air inlet or outlet through which air can pass.
GRILLE	A louvered or perforated covering for an air passage opening which can be located in the sidewall, ceiling or floor. Often louvers are adjustable for control of direction of the air flow.
HEATING LOAD (BTUH)	Heat lost by the conditioned space, usually to outdoors through the outside walls, and which must be replaced by heating.

HIGH VELOCITY	Generally applied to systems operating above 1500 fpm and 2" duct static pressure.
HUMIDITY RATIO	The humidity ratio of moist air is a weight ratio of water vapor to dry air. Also, humidity ratio is the means of water associated with unit mass of dry air, pounds of water per pounds of dry air.
INDUCTION	The entrainment (See Entrainment) of room air (secondary air) by the jet action of a primary air stream (supply air) discharged from an air outlet.
INDUCTION RATIO	A ratio of the volume of combined air (secondary air and primary air) to primary air only.
INLET STATIC PRESSURE	Static pressure drop between the inlet and discharge opening of the unit.
INTERIOR LOAD	Heat in BTU/hr. generated within the conditioned zone. Common heat sources are: lighting, people and power (business machines, fans, hot plates, etc.). As a rule, these loads require cooling.
INTERIOR ZONE	The space within the building which is not affected by weather and is separated from the outdoors by the perimeter zone.
ISOTHERMAL	An adjective indicating that process takes place at constant ("the same") temperature. Thus the air distributed in a room is isothermal when primary air is supplied at room temperature.
LATENT HEAT	Heat required to change the state of matter, to change water into water vapor at the same temperature; for example, contrary to the sensible heat, latent heat does not change temperature. In air conditioning, latent heat is associated with moisture.
LOAD	In a heating or cooling system the calculated maximum heat transfer that the system will be called upon to provide.
LOW VELOCITY	Generally designates air distribution systems operating under 2" W.G. of duct pressure and air velocities less than 1500 FPM.
MINI-DIFFUSER	Plug-in element containing pattern and damper controls. It is the adaptive diffuser that permits easy integration with a variety of ceiling structures.
MIXED AIR PATH	Air flow of the mixture of primary and secondary air.
NC CURVE	NC curve represents a reasonably acceptable balance of low to high frequency noise for particular situations.
OCCUPIED SPACE	The conditioned space to within 6" of walls and floor and up to a height of 6'-0".
OCTAVE BAND	An interval of frequencies such that the ratio between a given frequency and a higher frequency is two.
OUTLET	Any opening through which air is delivered to the conditioned space.
PSI	Pounds per square inch.
PWL	Sound power level (PWL) expresses, in decibels relative to the reference power of 10^{-12} watt, the total amount of sound power radiated from a source.

PATTERN

The air flow issuing from the outlet and entering the conditioned space, as may become seen by introducing smoke into the air flow. Pattern is characterized by direction, spread, throw, terminal velocity and drop (see each separately).

PERIMETER ZONE

Generally considered to be the exterior areas inward to 15' and the top floor of a building.

PLENUM

Generally, a relatively large volume of enclosed space acting as an air reservoir within the air distribution system. The space above the false ceiling is called ceiling plenum.

PNEUMATIC

Operated by gas, such as compressed air. In air conditioning it is common to use 20 PSI compressed air controls.

In principle, duct pressure operated controls are penumatic controls.

PRESSURE

a. Pressure is a force exerted by one body upon another. In air conditioning, the air pressure is the force exerted by the air.

b. Pressure is measured in PSI (pounds per square inch), (= inches of water column), and Hg (inches of mercury column).

c. Zero point—in air conditioning, all pressures are measured above and below the atmospheric (ambient) pressure, commonly in inches of water column.

d. Static pressure is the normal (perpendicular to the surface) force exerted by air upon the body moving with the flow.

e. Velocity pressure is the forward moving force of the air stream.

f. Total pressure, is the sum of the static pressure and the velocity pressure, both at the point of measurement.

g. Pressure head is the total pressure at the beginning (at the head) of the air distribution system required to make air distribtuion operative. It is often referred to the outlet of the supply fan.

h. Pressure drop is the static pressure difference measured between two points of the air flow.

i. Pressure—velocity equivalent. Static pressure representing potential energy can be converted into velocity which represents kinetic energy and vice versa. The conversion equivalent is:

1" W.G. is equivalent to 4005 FPM or

$$P = \left(\frac{V}{4005}\right)^2$$

P = Pressure
V = Velocity

PRIMARY AIR

The air delivered to the outlet by the supply duct.

REHEAT	A secondary process in which heat is added to the preconditioned supply air to the recirculated room air to permit control of temperature (a) for areas of unequal loading, (b) for perimeter rooms of various exposures, and (c) for close individual control. Steam, water and electrical reheat coils are used.
RELATIVE HUMIDITY	A measure of moisture content of the moist air, expressed in percent with 0% R.H. air having no moisture and with 100% R.H. air being saturated. By ASHRAE definition, it is the ratio of mole fraction. For practical purposes, the ratio of vapor pressure of moist air to the vapor pressure of saturated air at the same temperature and pressure.
RETURN AIR	Air returned from the conditioned space for filtering, cooling or heating, and dehumidification before it is recirculated as supply air. Part of return air is commonly discarded as exhaust air. This part is replaced by outdoor air.
REVERSE ACTING	Thermostat response characterized by an increase in line pressure (pneumatic) as a result of a drop in temperature.
ROOM VELOCITY (V_R)	The average residual air velocity level in the occupied zone of the conditioned space.
SECONDARY AIR	Temperature stabilized air existing in the conditioned space.
SENSIBLE HEAT	Heat that changes the dry bulb temperature of air.
SHORT CIRCUITING	The condition that occurs when the inlet is located within the supply air stream, causing a portion of the mixed primary and secondary air to divert into the return air before reaching the occupied zone.
SLOT DIFFUSER	Diffuser with one or more parallel slots for the passage of air, generally with the aspect ratio (length or width) in excess of 10 to 1. Air pattern can be vertical or horizontal, parallel to the ceiling and spreading from the ceiling down. Pattern is highly insensitive to drop.
SMUDGING	The deposit of airborne dust (carried by room air) on ceiling surfaces surrounding the air duffuser, caused by electrostatic forces (particles having opposite charge to the ceiling) and thermal precipitation (attraction to cold surface).
SPREAD	The maximum width of the total air stream at the point of the terminal velocity.
STANDARD AIR	Dry air at 70°F and 29.92 Hg pressure. Has .075 lbs./cu. ft. density.
STATIC PRESSURE	See Pressure.
STATIC REGAIN	Conversion of kinetic energy of the air flow into static pressure.
STRATIFICATION	Formation of stationary hot or cold air layer caused by each of air motion, defined as a region where room velocity is less than 15 FPM. Sign of poor air distribution.
TEMPERATURE DIFFERENCE	In air distribution, the temperature difference between the room air and primary air supplied to the room.

TERMINAL VELOCITY	A predetermined velocity occuring at some point in the mixed air path and used to determine throw.
THROW (blow)	A distance in feet from the outlet horizontally at which the air flow has reached the chosen value of terminal velocity.
TOTAL PRESSURE	See Pressure.
VELOCITY	a. The distance a point travels in a unit of time. In air distribution, the velocity of air is expressed in FPM (feet per minute) and in metals per second in metric system: 1 M/sec. = 197 FPM b. Duct velocity is the average velocity of air in the duct, calculated as volume, divided by the crossection: CFM/Sq. Ft. c. Outlet velocity V_k is either calculated by dividing air volume CFM by area factor Ak or measured in field with a calibrated velometer and 2222A jet as specified. d. V_t See Terminal Velocity. e. Velocity—pressure equivalent, See Pressure.
WEATHER LOAD	Heating or cooling load caused by the influence of weather. Applied to perimeter zones only.
ZONE	A building space having the same load pattern throughout and provided, therefore, with a single temperature control. Zone can be a single room, a portion of a large room, or a group of rooms small or large. Zone can be subdivided but subdivisions would have no individual controls unless added (comparatively easily done in VAV system).

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